Borough of Worthing.

EX TERRA COPIAM E MARI SALUTEM

REPORT ON M. HERMITE'S TREATMENT OF SEWAGE.

Health Department,
Worthing,
March 14th, 1894.

To the Sanitary Committee of the Worthing Town Council

Gentlemen,

In accordance with your request, I have examined carefully the process which has lately been carried out in Worthing for the treatment of sewage by M. Hermite. After having made numerous experiments, and having obtained the assistance of Dr. Klein, F.R.S., and Dr. Dupré, F.R.S., for a bacteriological and chemical inquiry, I now submit to you the following Report :—

The whole of the plant has been erected under the direction of M. Hermite, and the method adopted is that carried out by the inventor himself, so that this Report does not deal with the treatment of sewage at the outfall, nor with the mixed sewage of a town, but only with such sewage as the author of the process has seen fit to include.

The Hermite solution is obtained by the partial electrolysis of sea water. Two galvanized iron tanks, each capable of holding 1,000 litres, or 220 gallons, are placed side by side, while between and above them an electrolyser is placed in a small metal box. There are four rows of vertical rods, covered in their lower half by a mesh of fine platinum wire, which dip into the sea water contained in the box ; each row contains eleven such rods. Between these rows circular discs of zinc revolve when the machinery is in motion. The current, generated by a dynamo, which is driven by a portable steam engine, passes through the sea water between the electrodes of zinc and platinum, and in doing so it is said to decompose the magnesium chloride, and so to produce a disinfecting fluid.

A gallon of ordinary sea water contains about 2,275 grains of combined chlorides in solution, of which magnesium chloride amounts to about 256 grains, the rest being nearly all sodium chloride. It is stated that the magnesium chloride is alone decomposed, and that the sodium chloride serves as a conductor. It takes about 2 to 2½ hours to convert 220 gallons (1,000 litres) into a disinfecting fluid of a strength equal to 0·75 grams of chlorine per litre, but M. Hermite says that a solution containing 0·30 grams of chlorine per litre is sufficient for his system. No account is given of the chemical nature of the substance produced by his process; it is said to be an oxygenated compound of chlorine, but no chemical formula is given. The solution has a smell of a weak solution of bleaching powder, and M. Hermite contends that his solution is of a similar nature, with this difference, that magnesia takes the place of lime in a bleaching fluid.

Bleaching fluid is a solution of chlorinated lime; and his solution may then be called chlorinated magnesia. In each case hypochlorous acid seems to be produced in combination with a base, and this acid is one of the compounds of chlorine with oxygen.

When good commercial bleaching powder is treated with distilled water, a certain proportion is dissolved, and this fluid will give a strength equal in effect to 25 or 30 grams of chlorine per litre.

Such a liquid gives off a strong smell of hypochlorous acid, and it has active bleaching power when treated with a diluted mineral acid.

The strongest Hermite solution which I have examined contained 0·75 grams of chlorine per litre, or 0·52 grains per imperial gallon.

On several occasions the strength was much less, amounting only to 0·22 grams of chlorine per litre, while in most of the experiments a strength of 0·44 grams to 0·51 grams was obtained, or a quantity in excess of that (0·30 grams), which it is claimed will suffice for disinfection.

The strength of this standard may be better understood when I say that it is sixty times weaker than a saturated solution of good bleaching powder. The Hermite solution loses its strength when kept for a few days, even in closed vessels; two such samples lost nearly one-twentieth of their strength in two days.

The solution contains no free chlorine, as has been often alleged, and it does not redden litmus paper; it will decolorize sulphate of indigo at once, and its strength is thus ascertained:—A solution containing a known quantity of arsenious acid is taken, and of this 5 c.c. are placed in a small glass beaker, into which two or three drops of indigo solution are added, so as to give the liquid an intense blue colour. On adding the Hermite solution, no change in colour takes place until the arsenious acid is changed into arsenic acid, and when this is completed, the blue colour disappears, and the liquid turns to a pale yellow-brown colour. The strength of the solution can thus be quickly ascertained; the weaker the solution, the more is required for decoloration.

When treated with dilute hydrochloric acid, it gives off chlorine, and it will then bleach reddened litmus paper.

There is no treatment of sewage by electricity as in Webster's method. Electricity is only used to decompose the sea water, and the altered sea water, so produced, is allowed to act chemically on sewage.

The process has only been carried on upon a small scale in West Street. In Yard A the dynamo and the tanks are placed, and then the electrolysed fluid is pumped up into some store tanks, whence it is distributed for use as occasion may require.

In Yard B two new water closets have been recently put up, and these are in direct connection with one of the syphons used in the process.

In Yard C is a second syphon, also sunk in the ground, which receives the treated sewage from the similar syphon in Yard B, and also the ordinary sewage from fourteen cottages in West Street.

The store tanks in yard A are filled from the dynamo tanks; they are made of galvanized iron, and the water is distributed from them to the flushing tanks, but not to the sinks of each cottage.

There is also a galvanized iron pipe (attached to the public water main) which leads to one of the store tanks, and thus the tanks can be filled with the town water as well as with the treated sea water, so that if there were not enough of the latter produced, the cottagers would not be without a supply for flushing purposes.

It would indeed be well worth while to cease using the electrolysed sea water for a time, and to see what would be the effect of sending through the temporary system—1, sea water, and 2, town water—for a period of seven days each. No further arrangements would be required, and it would be interesting to note what difference would be met with when the three methods were compared.

There is a difference in the arrangement in the two yards B and C.

In yard B there are two new water closets erected, each provided with a short hopper basin and trap delivering into a short and partly open drain, which leads directly to the syphon. Each closet has a flushing tank which holds from two to three gallons, and which is supplied directly from the store tanks in Yard A. No storm water, nor subsoil water, nor any dirty house water can pass down this drain, and the syphon only receives such material, liquid or solid, which has passed through the closets. There is, however, a tap in this Yard, which is supplied from the store tanks, and whence water can flow at once into the temporary drain, and so into the syphon without going through the closets.

The syphon in Yard B acts as an intercepting trap whereby anything smaller than the meshes of the cage can pass away into the sewer. It is clear that since any solid matters are, as a rule, broken up on or before their arrival at the syphon, they will pass on at once to the sewer with each successive flush, or whenever there is a current of water issuing from the tap. After a closet has been in use, the next flush will allow a certain amount of fresh fluid to enter at the top of the syphon, which will then cause a similar amount of the contents to be displaced and flow forward towards the sewer. If this process be repeated a few times, without any more excreta passing from the closets, the original fluid will be all driven forwards, and the syphon will then be full of water only. It matters not how often these closets are used, for if after such use sufficient clean water passes down the drain, the syphon will soon be filled with this clean water, and any samples taken from the small drum beyond the syphon bend will be samples of clear water only; and, if the electrolysed fluid be used, the samples will be those of electrolysed fluid only. The only solid matters left in the cage will be portions of papers which are too large to pass through the perforated holes of the cage. At certain times there must be some solid matter, and then the effluent is more or less tinted.

The case is different with regard to the arrangements in Yard C. Here not only the closets but the dirty house water from 14 cottages, as well as the treated sewage from Yard B, is constantly passing into the syphon. There is also a considerable amount of storm-water, which flows from the roofs and yards of the houses when there is wet weather. The amount of sewage will be very small at night time, but during working hours, and especially on washing days, a large amount of dirty water must constantly be running from the houses away to the sewer. One can tell roughly the nature of the fluid by its appearance before it enters the syphon; sometimes it is clear and almost free from house refuse, as when there is a rainfall, and the closets and house drains do not happen to be in use. At other times the fluid has the usual appearance of ordinary liquid house refuse. There is no separate tap here by which a quantity of water can be sent down from the store tanks; each closet is supplied by a flushing tank, which is fed from the store tanks.

Nevertheless, the town water being laid on to the interior of each house, the water from the sinks and the water used for washing and cooking is free from the disinfecting fluid until it enters the drains.

Any sample taken from the small drum in Yard C during working hours will be sure to contain some sewage of greater or less strength.

Any samples taken from the small drum or the cylinder in Yard C will furnish a better proof of the efficacy of the Hermite process, than samples taken in Yard B, where it is possible that nothing else than the disinfecting fluid may be drawn.

When 20 ounces of fresh excreta—*i.e.*, 4oz. solid, and 16oz. liquid—were placed in a gallon of Hermite solution there was no bleaching, and no breaking up nor destruction of the solid matter; the only effect was to conceal the odour of the contents, and to delay decomposition. When to 20 ounces of this treated mixture three times the amount, or 60 ounces, of Hermite solution were added, there was still no

bleaching nor decomposition, but simply dilution of the original mixture, and the contents were partly deodorized. The Hermite solution used was of the strength indicated by 0·61 grams of chlorine per litre. Dilution with sea water only produced results similar to those met with when the electrolysed fluid was used; but in the latter case the colour was not so intense.

Both fluids prevented the decomposition of the excreta, and the Hermite solution produced in addition a small amount of bleaching effect.

When the proportion of excreta was 1 in 32 of the Hermite solution, its presence was easily detected; but when a solution of chlorinated lime of similar strength was used better results were obtained, and there was complete discolouration.

When strong chlorinated lime solution was tried, the contents were decomposed with evolution of froth; the fluid was bleached, and the liquid soon separated, on standing, into a clear portion and an abundant white flocculent deposit. The change with the Hermite solution was one of dilution chiefly, and not decomposition; the resulting fluid never became clear, and there was no white flocculent precipitate. With weaker solutions obtained from the process, the results were much the same as when sea water only was used.

When dirty house water was taken from Yard C, after passing through the syphon, it was nearly as foul as before entering, but any solid matters were, of course, retained, when they were not small enough to pass through the holes in the cage; the perforated cage on the house side of the syphon acted simply as a coarse strainer.

When to this treated effluent varying portions of Hermite solution were added, the chief effect again was one of dilution only, and there was but little trace of any bleaching action. In the proportion of one of this sewage to 10 of the disinfecting fluid the resultant was still foul. Strong chlorinated solution at once produced decomposition, followed by clearing up of the fluid and abundant flocculent precipitate.

I have tried several experiments with a view to see what effect the electrolysed fluid would have when various materials were exposed to its action for several days or weeks. To make a proper comparison three sets of bottles—each holding one pint—were filled with different liquids.

In series A, ordinary sea water was used, the water being allowed to stand for a few hours, so as to allow of any sand or suspended matters to settle, and then the clear liquid was poured into each bottle.

In series B, a saturated solution of chlorinated lime was taken, and after subsidence the clear fluid was used to fill each bottle.

In series C, a similar set of bottles was filled with freshly prepared electrolysed liquid of known strength.

It was necessary to make these three sets of experiments, so as to see what action was due to the sea water acting alone, and what was due to it after it had been treated. Since chlorinated lime water is analogous in composition to the electrolysed water, it was used to see what action it would have on the ordinary substances used in sanitary apparatus. Although very much stronger in its action than any Hermite solution, it served as a guide to point out what materials would be most affected, or what substances would resist attack.

It is clear that if the stronger solution did not affect any articles which were placed in it, and which were exposed to its action for many weeks, it might fairly be assumed that they would still more easily resist the disinfecting fluid.

If, on the other hand, any articles were injured or corroded by the chlorinated lime water, it would be equally fair to assume that the Hermite solution would act in a similar, but less severe manner.

The amount of harm done would, in a given time, be of course greater when the strong solution were employed, but the injury done would be chiefly a matter of time. A substance exposed to the action of the electrolysed fluid for several months might be as much injured as one exposed to the lime solution for a few days.

All the experiments were carried on under similar conditions, but all the solutions were in a state of rest. In this point, they differed from what would occur in actual practice where the fluid is constantly changing, and any rust or corroded particles could be carried away in the current, and escape notice.

To allow for this loss, the bottles, at intervals of a week, were partly emptied, any clear fluid was doured off, and they were refilled from the original solutions, or from solutions of a precisely similar nature freshly obtained.

The following list shows that on the first nine substances the three fluids had no effect. On metallic bodies, as iron and copper, the effect was very marked, but lead, zinc, and tin showed no appreciable difference:—

Material.	Sea Water.	Chlorinated Lime Solution.	Hermite Solution.
Mortar	No effect.	Split into layers.	Slight flaking.
Neat Cement	No effect.	No effect.	No effect.
Cement	No effect.	No effect.	No effect.
Clay	No effect, beyond crumbling.	No effect, beyond crumbling.	No effect, beyond crumbling.
Paper	No effect; no bleaching of ink on printed paper.	No effect; no bleaching of ink on printed paper	No effect; no bleaching of ink on printed paper.
India-rubber	No effect.	No effect.	No effect.
Insertion (2 ply)	No effect.	No effect.	No effect.
Water Dressed Leather	No effect.	Softened.	Softened.
Oil Dressed Leather:—			
1. Dyed	Solution colored brown	Solution colored brown.	Solution colored brown.
2. Thin Harness	No other effect.	No other effect, beyond a white deposit on the surface of the material.	No other effect.
Copper (thick wire)	Pale sea green precipitate and deposit on metal.	Much dark lake precipitate and deposit on metal.	Blue green precipitate and deposit on metal.
Black Iron	Dark brown green deposit.	Copious formation and deposit of rust; much destruction of metal.	Abundant formation and deposit of rust with destruction of metal.
Galvanized Iron	No marked change.	Slight erosion of surface and loss of zinc coating	No marked change.
Zinc	No effect.	Slight erosion.	No change.
Tin	No effect.	No effect.	No effect.
Brass Fittings	Same as copper.	Same as copper.	Same as copper.

Since iron was the metal most liable to injury, a further trial was made. Three short pieces of one-inch black iron pipe and three short pieces of one-inch galvanized iron pipe were taken, and each piece was separately marked and carefully weighed.

Four pieces (two of each kind) were then placed in chlorinated lime solution and electrolysed fluid, and the remaining two pieces (one of each kind) were set aside for comparison.

The four pieces were kept in the solutions, in four separate bottles, for nineteen days, when they were taken out, dried, and re-weighed.

	CHLORINATED LIME SOLUTION.	HERMITE SOLUTION.
Black Iron 1in. Pipe.	MARKED IV. Original weight = 93·5374 grams. Final weight = 89·9084 grams. Loss = 3·6290 grams, or 56 grains.	MARKED V. Original weight = 97·7494 grams. Final weight = 97·2310 grams. Loss = ·5184 grams, or 8 grains.
Galvanized Iron 1in. Pipe.	MARKED I. Original weight = 87·2517 grams. Final weight = 81·3647 grams. Loss = 5·8870 grams, or 91 grains.	MARKED II. Original weight = 94·1207 grams. Final weight = 94·1855 grams. Gain = ·0648 gram, or 1 grain.

The slight gain in the last case was due to a little white deposit which adhered strongly to the surface of the galvanized iron.

I have not gone into the question of cost, as that is a matter for engineers; nor into the question of trying the process on sewage when it has passed into the sewers, nor upon sewage at the outfall, since the present experiments have only been applied to houses.

Besides the annual cost of producing sufficient fluid, there would be a very great outlay in putting down a fresh set of mains, pipes, and cisterns, so as to convey it to each house.

Moreover, each house, or each group of small houses, would require to be furnished with a syphon.

In addition, I give the results which have been obtained from chemical and bacteriological analysis The samples were taken on the day when M. Hermite explained his system on his recent visit to the town.

CHEMICAL ANALYSIS.

Three samples, collected on February 26th, 1894, were sent to Dr. Dupré, F.R.S. of Westminster Hospital. They were from the following sources :—

I. M. Hermite's solution, taken in Yard A.

II. Sea water.

III. Sewage effluent in Yard C, after treatment with the electrolysed fluid.

Each sample was sent in a Winchester quart bottle, sealed and stoppered. Dr. Dupré, in his report dated March 9th, 1894, states as follows :—

"I. M. HERMITE'S SOLUTION.—The water contains a small proportion of hypochlorite, probably Magnesium or Sodium, equal in effect to to 0·72 grams of Chlorine per litre, or of 50·4 grains per Imperial gallon. The sample contained 1315 grains of combined Chlorine, equal to 2167 grains of Chloride of Sodium per gallon.

"II. Sea Water.—The sample of untreated sea water sent contains no hypochlorite or free chlorine, and 1315 grains of combined chlorine per gallon, which is about the normal amount in pure sea water.

"The sewage is of dark brown colour and very turbid; it has no offensive sewage smell, but has a somewhat disagreeable beery smell. It still contains a small amount of hypochlorite. The amount of oxygen absorbed is extremely high, about four times as much as in the case of ordinary London sewage. The proportion of free ammonia is low for a sewage, but this may, however, be due to its being fresh. The amount of albumenoid ammonia yielded is extremely high. The sample of sewage is evidently of somewhat abnormal character, and does not seem very well suited for experimental purposes. Without a direct comparison between the treated and untreated sewage, it is impossible to say what improvement the treatment has effected.

"I may say, however, that this sample does not smell like ordinary sewage, and has not developed an offensive sewage smell after a week's keeping.

"Judging from the amount of combined chlorine present, compared with that of sea water, either a far smaller proportion of sea water has been used for flushing than water in the case of ordinary water closets, or else the sewage is otherwise mixed with much water."

ANALYTICAL DETAILS.

Appearance	Turbid, filthy-looking.
Colour	Dark brown.
Smell	Not offensive, but somewhat beery smell.
Deposit	Much foul.
Nitrous Acid	———
Phosphoric Acid	———
Oxygen absorbed from permanganate ..	20·3 grains per gallon.
Total dry residue	1264·0 ,, ,,
Colour of ,, ...	Dark Brown.
Behaviour of ,, on ignition	Much charring, evolves slight smell of urine and nitrogenous matter, also that of residue from beer.
Chlorine	538·0 grains per gallon.
Ammonia	·931 ,, ,,
Albumenoid Ammonia	2·45 ,, ,,
Hypochlorite equal to free chlorine ..	0·026 ,, ,,

BACTERIOLOGICAL ANALYSIS.

Three samples, collected on Feb. 26th, 1894, were sent to Dr. Klein, F.R.S., of St. Bartholomew's Hospital; they were from the following sources:—

A. Sewage effluent in Yard C, after treatment with the electrolysed fluid.

B. Sea water.

C. M. Hermite's solution taken in Yard A.

Each sample was sent in a Winchester quart bottle, sealed and stoppered.

Dr. Klein, in his report dated March 5th, 1894, states that

"Sample A was a very turbid fluid, with a large amount of floccular matter suspended in it; it had no offensive smell.

"Sample C was clear, and had a strong chlorine smell.

"Cultivations were at once made from the three samples:

"SAMPLE A.—(1) One plate was made with 1·0 cc, and one plate with 0·1 cc of the fluid.

(2) 500 cc were driven through a Berkefeld filter.

This fluid took, owing to the very large amount of solid matter suspended in it, nearly an hour to pass through the filter; the same quantity of water would, as a rule, take about ten minutes.

"The particulate matter of the outside of the filter was then brushed off, suspended in 10 cc of sterile water, and with 1 cc of this each of two gelatine tubes were charged and used for plate cultivation.

"Result: In both the plates of series 1 (*i.e.* charged with 0·1 and 1·0 cc of original fluid A) numbers of colonies of bacteria developed: an estimation of their number showed that *fluid A contained per 1 cc between 800 and 1,000 living microbes.* From the various colonies of these plates the following species have been isolated: (*a*) bacillus coli, very numerous, (*b*) bacillus subtillis, (*c*) proteus vulgaris, (*d*) bacillus ulna, (*e*) bacillus mesentericus, (*f*) a non motile cylindrical bacillus, not liquefying, (*g*) various species of cocci. It follows from this that of the species that developed, several are such as do not form spores—*e.g.*, bacillus coli, proteus vulgaris, and the several species of cocci.

"In the plates of series 2 (that is those which each received the solid matter of 50 cc of the original fluid) the number of colonies that came up in 48 hours was so great, and the liquefaction so extensive, that they were practically useless for counting them or determining their character.

"Now this sample A, as far as I understand the description given on the label and in your letter, was sewage that had been subjected to the treatment after M. Hermite's process. Ordinary raw sewage of London, Manchester and other towns that I have examined, contains between three millions and ten millions of bacteria per 1 cc; this 'treated' sewage effluent of Worthing, as stated above, contains only 800 to 1,000 microbes per 1 cc; it follows that there has been effected by the admixture of the Hermite solution a remarkable reduction in the number of living microbes, but it also follows that nothing like sterilisation has been produced, since a considerable number of bacteria have survived the process; and be it also noted that amongst those that survived are several species that do not form spores, so that an assertion to the effect that the highly resisting spores are not killed, whereas non-sporing baccili are killed by the process, is not borne out by these observations.

"A further experiment was made with this sample A on March 3, *i.e.*, after it had been kept four days. With ½ cc of the fluid A, a gelatine plate was made and the result watched. On the third and fourth day the number of colonies were counted, and as a result it was found that their number had increased meanwhile more than fourfold. Cultivations made after six days keeping showed that the number of microbes had meanwhile increased more than one hundredfold.

"Sample B. A plate was made with 1 cc of this sea-water. The number of colonies that came up was too great to be counted; in fact, the gelatine was densely pervaded by colonies. A plate was made with 0·01 cc of the water, having been kept for two days. The number of colonies was estimated to be 1,000 per 1 cc.

"Sample C was treated in the same manner as Sample A. Result: The fluid proved sterile, only two colonies were noticed in one plate made with the particulate matter of 100 cc of the sample; the companion plate was free of any growth.

"Now, this result is extremely interesting, for it proves that sea-water, containing a very large number of living microbes (Sample B), becomes practically sterilised by the Hermite process (Sample C).

"In order to ascertain further whether cultures of non-sporing bacilli, when mixed with Hermite's solution become sterilised thereby, I made the following experiments; but I should repeat here that I had no great hopes after the results obtained with Sample A, for we have seen that this sample was not anything like sterile, still containing 800 to 1,000 microbes per 1cc.

"Broth cultures of (1) Bacillus coli, (2) Bacillus of typhoid, and (3) Choleravibrios, were mixed each with the same bulk of Hermite solution (C), and after thoroughly shaking were left standing for 20 minutes, and from them subcultures were made in normal nutritive media: in broth and in gelatine, each culture tube receiving one drop of the mixture. The result was this: *All subcultures in broth showed growth*, the broth cultures were uniformly turbid in 24 hours incubated at 37°c; the gelatine tubes of the bacillus coli and the choleravibrio incubated at 20°c, showed numerous colonies after 48 hours, those of the typhoid

developed a small number of colonies after four days. This is quite in harmony with the experience repeatedly made, viz.: after allowing the disinfectant to act on the microbes, it is necessary to expose the subcultures made from the 'treated' material to 37°c, in order to avoid a hasty conclusion; repeatedly it has been found that while subcultures exposed to 20°c failed to give a positive result in two days, those exposed to 37°c yielded good growth. The growth which appeared in these different subcultures in broth was tested by further subcultures, and thereby it was ascertained that the same microbes that were used for the initial experiment were recovered in their perfectly normal characters. There is one point in connection with this series of experiments which is of importance, and this is—that by the addition of the same bulk of Hermite solution to the original normal cultures, the number of living microbes had decidedly become reduced, although a good many living examples were still left. This was determined in the following manner: From the original normal cultures 1, 2, and 3, a definite quantity was withdrawn mixed with the same bulk of sterile salt solution, and from this mixture plates in Agar were made and incubated at 37°c, in order to determine the number of microbes per 1cc. After the treatment of the original cultures with the same bulk of Hermite solution for 20 minutes, similar plates were made and the number of colonies coming up in these plates was compared with those of the previous control plates. It was found that by the Hermite solution the number of living microbes was reduced something like over 100 times.

"A further experiment was made with these broth cultures of colon, typhoid and cholera, to which an equal bulk of Hermite solution had been added, it was this: after keeping the mixture for 24 hours, inoculation was made into fresh sterile broth, each tube receiving about five drops of the 'treated' culture. The result was interesting: the bacillus coli and cholera vibrio yielded normal growth, the typhoid did not yield any growth. So that even after 24 hours' exposure of broth culture of bacillus coli and of cholera vibrio to an equal bulk of Hermite's solution, each five drops of the coli-fluid and the cholera-fluid still contained living microbes, while the typhoid fluid appeared sterile.

"Now, it is maintained by the 'Hermite system,' as explained in the printed leaflet which you kindly sent me, that 'fæcal matter is instantaneously destroyed (meaning, of course, sterilised) when mixed with the electrolysed disinfecting liquid.' The above experiments show that this was not the case with the sewage operated upon at Worthing, nor was it the case when cultures of bacillus coli, bacillus of typhoid or of cholera vibrio, were subjected to the liquid. I do not know what is the proportion of Hermite solution that this 'Hermite system' recommends to be added to 'fæcal matter' in order to sterilise it, but it must be quite clear from the above experiments on the broth cultures that even an equal bulk of Hermite solution added to the cultures does not by any means sterilise them even after 20 minutes' exposure, and some not even after 24 hours. Whether such an addition (*i.e.*, equal bulk) in regard to sewage is possible in practice, is a matter on which I do not wish to give an opinion, but anything equal, or *à fortiori* anything less, would for sterilisation purposes be vain. Of an 'instantaneous' action there is nothing to be noticed in the above experiments."

Since there is no instantaneous decomposition of fæcal matter, and no sterilisation of sewage, I am of opinion that the process, as far as the late trials have gone, has therefore failed to produce the results which are claimed for it by its inventor.

I am, Gentlemen,

Yours obediently

C. KELLY, M.D.,

Medical Officer of Health.

REPORT

BY

Dr. KELLY

TO THE

TOWN COUNCIL OF WORTHING,

ON

M. Hermite's Treatment of Sewage.